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Fluid Structure Interaction of Flow and Heat Transfer around a Microcantilever

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Abstract : This study emphasizes on analyzing the effect of flow conditions and the geometric variation of the microcantilever's bluff body on the microcantilever detection capabilities within a fluidic device using a finite element fluid-structure interaction model. Such parameters include inlet velocity, flow direction, and height of the microcantilever's supporting system within the fluidic cell. The transport equations are solved using a finite element formulation based on the Galerkin method of weighted residuals. For a flexible microcantilever, a fully coupled fluid-structure interaction (FSI) analysis is utilized and the fluid domain is described by an Arbitrary-Lagrangian–Eulerian (ALE) formulation that is fully coupled to the structure domain. The results of this study showed a profound effect on the magnitude and direction of the inlet velocity and the height of the bluff body on the deflection of the microcantilever. The vibration characteristics were also investigated in this study. This work paves the road for researchers to design efficient microcantilevers that display least errors in the measurements.

Keywords : fluidic cell, FSI, microcantilever, flow direction
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